Unsinkable Ship to Defy U-Boat Torpedoes

New York Engineer's Device Applied to Seized Austrian Liner Thousands of Boxes Give Buoyancy

COAL at $100 a ton is what our Italian allies are ready and willing to pay for that fuel if we can deliver it. This is the best evidence of how much a shortage of coal hampers industrial activity over there. This fact, in short, is the primary reason for being of the unsinkable steamship Lucia of which the public has heard a good deal of late.

The Lucia was launched at Trieste nearly six years ago and carried the Austrian flag until commandeered by the United States Government. She is 418 feet long, has a beam of 54 feet and a depth of hold of 37 feet. Her gross register is nearly 7,000 tons and when full laden she is capable of making between 13 and 13½ knots an hour. She is a fine vessel and well worth the efforts of the Ship Protection Committee to make her relatively immune to torpedo attack.

SHOWING BUOYANCY BOXES STOWED BETWEEN DECKS

Invention of New York Man.

The craft's novel non-sinkable feature is the invention of William F. Donnelly of New York city, a consulting engineer, who has specialized in problems of flotation for a number of years. Curiously the present system may properly be described as an evolution of discoveries made during the designing and building of a great 20,000 ton floating dry dock, now located at Prince Rupert, British Columbia. The story of Mr. Donnelly's connection with that structure should be told first in order to get a better understanding of how he came to plan his "buoyancy boxes" for the steamship Lucia.

Prince Rupert is at the western terminal of the Grand Trunk Pacific and the home port of an important line of steamships sailing thence to Japan and China. It was to provide repair facilities for these vessels that the floating dry dock in question was ordered. The harbor is a very deep one. Just about the time that Mr. Donnelly had his plans started the United States floating dock Dewey sank in the port of Manila, where the depth of water was so moderate that it made the salvor's task a relatively simple one. But Mr. Donnelly recognized that the situation was quite different at Prince Rupert, and was convinced that his dock should be built in a fashion that would make her unsinkable in spite of something going wrong or an injury under water. Let us quote him:

Wood Did Not Corrode.

"As designed, the Prince Rupert dock was fashioned of 2,300 tons of steel in the upper part, carried 500 tons of pumping machinery, &c., and had a supporting structure of wood totalling 4,000,000 feet of lumber. The timber section for under water was chosen because that is the part of a floating body of steel which corrodes quickest, while wood is substantially indestructible if submerged. That amount of timber, however, constituted in itself a buoyant mass which could not be made to sink to the desired depth by simply admitting water in the lower ballast tanks. Indeed, the calculations soon made it plain that I should have to put 500 tons of dead weight into the dock somewhere in order to make it possible to submerge it when receiving a vessel.

"Most timber floating dry docks neutralize their excess buoyancy by stowing rock ballast in their submerging compartments. But stone loses substantially half of its weight when immersed, and, therefore, it would have been necessary for me to have loaded down my dock at Prince Rupert with 1,000 tons of ballast of this sort if I put it in the customary places below the water line. This would have been objectionable for a number of reasons. Accordingly, I asked myself the question, why not put 500 tons of rock far enough above the water line so that it would never lose weight by submergence but would always be high and dry when the dock was sunk to her deepest draft?

Fatal Weakness in Plan.

"At first blush that seemed to be a satisfactory solution of the problem, but upon second thought I discovered a fatal weakness in the scheme: If by any accident the dock should sink further, then the stone ballast would help by its dead weight to carry the structure right on down to the bottom of that very deep harbor. That was a contingency against which it was necessary that I should provide. A slip of that sort would be pretty sure to mean a total loss. Then I queried, why not use wood for ballast and place it in the wings of the dock well above the maximum draught when submerged? That was the desired solution. I found that 500 tons of timber stowed in that way would become 750 tons of buoyancy should the dock sink far enough to bring that wood into the water, and, therefore, constitute a very effective supporting or lifting force in case of mishap—an impulse that would suffice to keep the structure from disappearing.

"It calls for no stretch of imagination to see how I was led to suggest wooden boxes as a means toward increasing the flotation of a torpedoed ship. My scheme consists essentially of a series of boxes which can be packed in between the hull frames and between the deck beams of a ship, forming a permanent safety installation, and of other and larger non-sinkable boxes which shall absorb any space in the cargo holds not filled with freight—the number of the latter depending of course upon the nature and the volume of the freight carried.

"My first efforts to make the boxes water tight were not successful. I covered them with painted canvas or a bituminastic composition, but these did not suffice to keep the water without. Finally it was found that really reliable water tightness could be insured only by sheathing the wooden boxes with galvanized iron and carefully soldering all of the joints. This answered admirably, and every box so sealed has withstood the designed hydrostatic crushing stress that it may be subjected to in service if the vessel is torpedoed and her compartments flooded by the sea.

Stowed in Waste Space.

"The boxes that are stowed between the hull frames and deck beams are 12 inches deep, 24 inches wide and 36 inches long, and pack easily and snugly into the spaces provided by the Lucia's structure. The cargo boxes, those that are put in the freight compartments, are 2½ feet deep, 2½ feet wide and 6 feet long. The boxes have been standardized so that it is possible to utilize lumber of a uniform size for the different types. The total number of boxes in the steamship Lucia is between 9,000 and 10,000; and while these do represent in the unharmed ship a dead weight of hundreds of tons still, because of their bulk and watertightness, they would exercise, if the vessel were torpedoed, a lifting impulse capable of sustaining the steamer and her cargo."

Probably the best idea of the Donnelly plan for rendering a ship unsinkable can be had if we liken the scheme to certain well known types of sectional or unit bookcases. This simile becomes more apparently apt, so far as the cargo boxes are concerned, if we bear in mind that they are designed to be piled upon one another and packed in the holds so as to leave just room enough for the freight which is to be carried.

Fitted Especially for Coal.

The installation placed aboard the steamship Lucia was to fit her for taking coal to one of our allies and therefore she is typical of an extreme case calling for numerous buoyant boxes. For the sake of those who may be fond of figures, coal occupies forty-three cubic feet of space a ton. Because of its density, compared with hemp, which bulks 100 cubic feet to the ton, it is evident that while it is possible to fill a ship's holds with hemp and bring her down to her load line, she would reach that point of flotation with her compartments less than half filled with coal. Therefore if struck by a torpedo the inrushing sea would have a large area to flood, and to just that extent would the inundation reduce or destroy the buoyancy counted upon to keep the vessel afloat.

Of course, it must not be supposed that Mr. Donnelly counts upon his special buoyant units to furnish the entire protection to the vessel. He naturally expects the double bottom and other water tight parts of the craft to do their supporting bit. It is not conceivable that a single torpedo, or two of them for that matter, would be able to open up but a moderate part of the double bottom space if the attack damaged that region at all; and the steadying and sustaining effect of the boxes would tend to prevent buoyant air, caught in pockets under the decks, &c., from escaping. This imprisoned air would help by just so much to neutralize the dead weight of the inundating water.

Cargo Reduction Slight.

It has been objected that by his various boxes Mr. Donnelly has reduced the cargo carrying capacity of the steamship Lucia by about 14 per cent. of her freight space. Those intimately familiar with the actual conditions put the reduction of cargo area at 10 per cent. Be this as it may, the fact remains that the sacrifice is probably well warranted, especially when every ton of certain commodities is vitally needed by our allies.

In case of the vessel in question the work of providing both buoyancy boxes and the cargo boxes called for an expenditure of substantially $150,000. This was necessitated by the novelty of the undertaking and the circumstances connected with the work. However, Mr. Donnelly is certain that any merchant craft can be safeguarded by his system for an outlay not exceeding one-tenth of her building cost. This might seem to be a pretty heavy surcharge, but a little analysis leads to another conclusion. Manifestly, the protected vessel would obtain better rates of insurance, and her useful career would, in all probability, be measurably prolonged, notwithstanding the menace of the submarine. As Mr. Donnelly figures it, an ocean going freighter normally renders during her active years a service valued at quite ten times her original cost. Therefore the ultimate outlay for the Donnelly buoyancy boxes would represent but 1 per cent. of the craft's gross returns.

Strange as it may seem, it is said that there is marked indifference among shipowners generally toward the seemingly prime question of reducing the probability of their vessels going to the bottom if wounded by a torpedo. In case of loss they know the underwriters will pay up; and the underwriters are not overconcerned because the price of insurance and their own losses are guaranteed. Sooner or later the sums involved come out of the public purse. Shipowners realize that the fewer the craft available the higher the freight charges that they can levy for service, so the mere destruction of boats does not arouse them as the man in the street might imagine.

Facing Actual Test Now.

The unsinkable ship is something to be heartily desired, especially if it can be made so promptly and without a prohibitive outlay. Mr. Donnelly's scheme has yet to be put to the crucial test; but in the absence of that trial under fire there is technical evidence that it will meet the demands that may be made in the hour of stress. The feature about his plan that is particularly noteworthy is its element of flexibility in dealing with the varying requirements of different sorts of cargo; and finally even the untechnical can grasp the fundamental fact that his thousands of buoyant boxes form just so many separate water tight and self-sufficient air filled compartments, thus subdividing open spaces that would otherwise flood easily should the hull be pierced by a blow. Each undamaged box could then be relied upon to do its share to hold up the stricken craft and possibly make it feasible to tow her into a friendly haven.

Should the steamship Lucia's equipment meet expectations, it is not unlikely that the method would open the way to further safety upon the sea even in times of peace and contribute to the reduction of maritime losses, which normally amount to many millions of dollars worth of property every year. Standardized buoyancy boxes of both types would be common features if Mr. Donnelly's idea prevails at every port of any size; and those for dealing particularly with the problem presented by different sorts of cargo would be taken aboard or discharged at the loading points agreeably to the requirements in each case.

Carnegie's Ambition Balked

ANDREW Carnegie in his early days had an ambition to enter the newspaper business, but when he failed to obtain a position on the Pittsburg *Despatch*, he turned his talents in other directions and finally became America's leading iron and steel manufacturer.

Robert Burns, on the other hand, spurned efforts to induce him to go into journalism and thus made the way clear for his becoming the most beloved of Scottish bards. These points were brought out in an address recently given by William Will, president of the London Burns Club.

The first attempt to get Burns in the newspaper line was when Peter Stuart of the London *Morning Post* started the *Star*. Burns declined to give active assistance in turning out the paper, although he occasionally contributed articles. Later James Perry, proprietor of the London *Morning Chronicle*, offered Burns £5 a week to join the staff. Burns refused the offer on the plea that his duties as an excise officer would prevent him from attending to the work. Nothing ever resulted, either, from the suggestions that Burns write a three act comic opera.